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Yoneda

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(54) **INK JET PRINT HEAD MANUFACTURING METHOD AND INK JET PRINT HEAD**

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(73) Assignee: **Canon Kabushiki Kaisha**, Tokyo (JP)

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B41J 2/175 (2006.01)
B29C 65/48 (2006.01)

(52) **U.S. Cl.** **347/87**; 156/295

(58) **Field of Classification Search** 347/20, 347/66, 86, 87; 156/91, 92, 293, 295; 29/890.01
See application file for complete search history.

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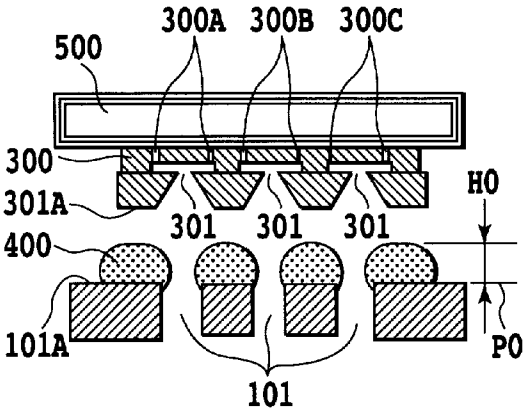
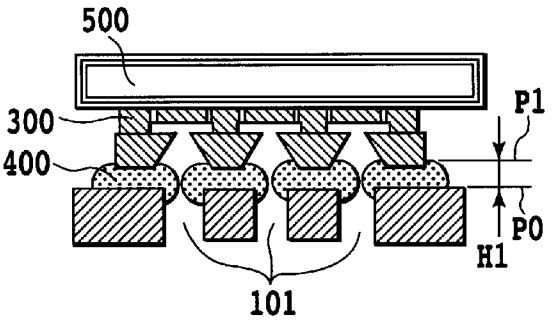
(74) *Attorney, Agent, or Firm* — Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

An ink jet print head manufacturing method and an ink jet print head are provided in which a shape of an adhesive that bonds a support member and a print element substrate together is controlled to maintain a high level of ink ejection performance even if the print element substrate is reduced in size. The adhesive, after being disposed between the support member and the print element substrate, is elongated and then hardened. This process allows the shape of the adhesive to be controlled, securing a sufficient ink path between an ink supply port on the support member side and an ink introducing port on the print element substrate side.

10 Claims, 11 Drawing Sheets





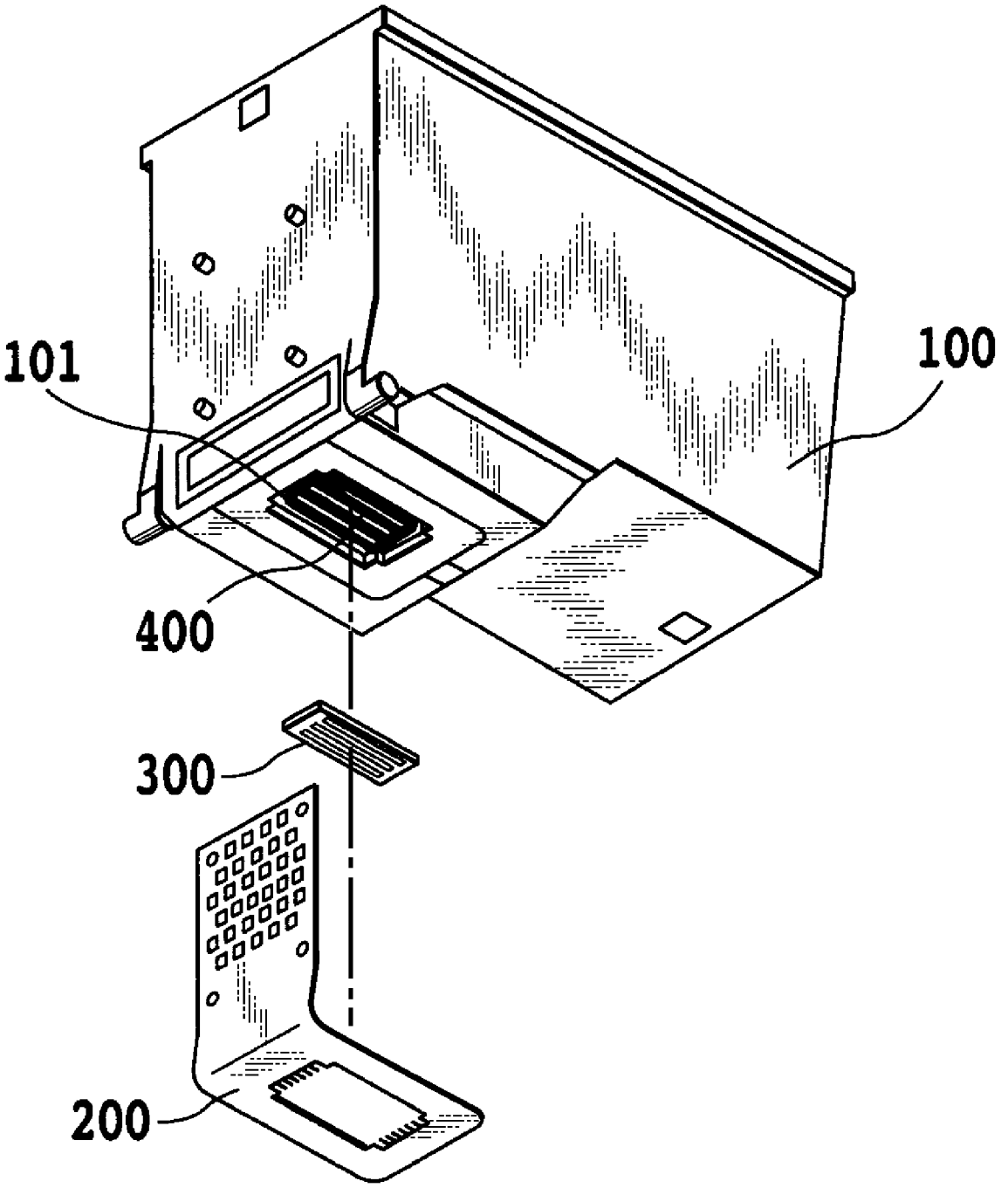


FIG.1

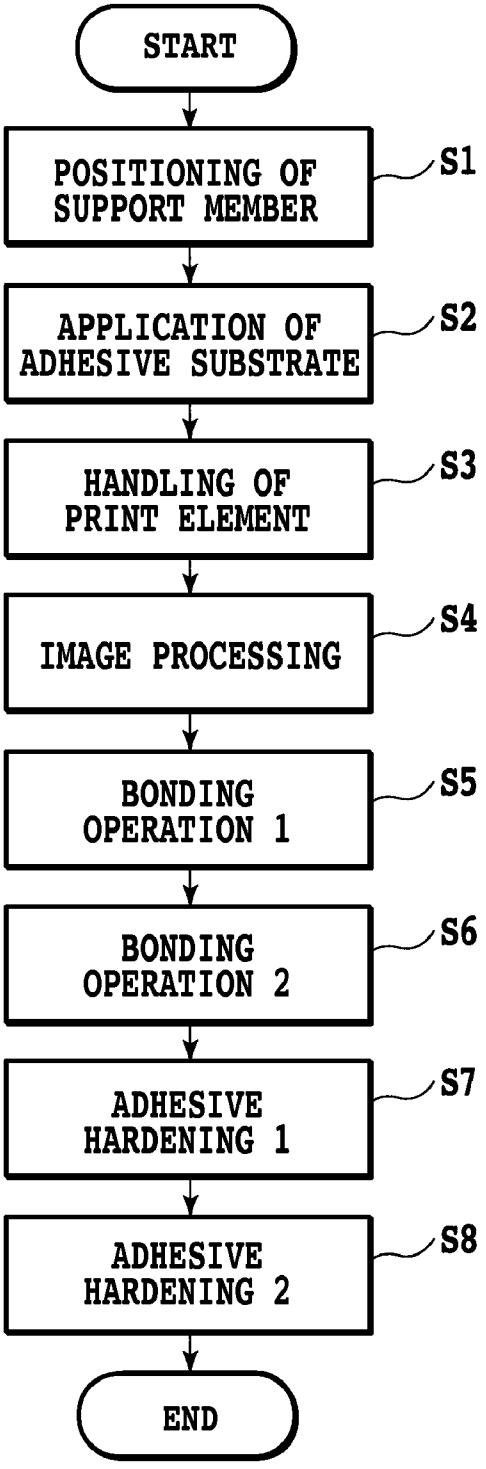

START
POSITIONING OF SUPPORT MEMBER
S1
APPLICATION OF ADHESIVE SUBSTRATE
S2
HANDLING OF PRINT ELEMENT
S3
IMAGE PROCESSING
S4
BONDING OPERATION 1
S5
BONDING OPERATION 2
S6
ADHESIVE HARDENING 1
S7
ADHESIVE HARDENING 2
S8
END

FIG.2

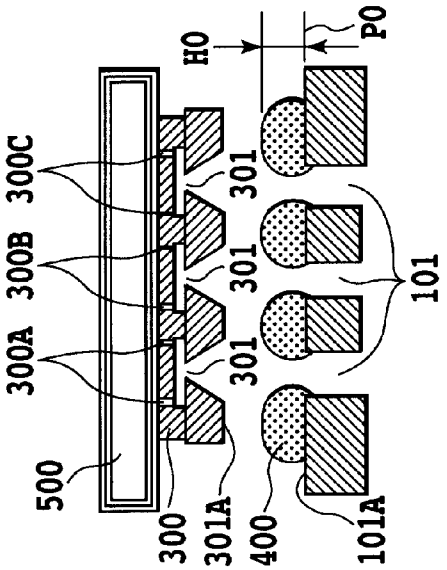


FIG. 3A

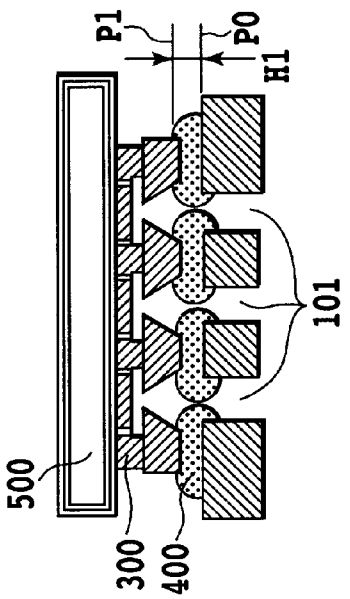


FIG. 3B

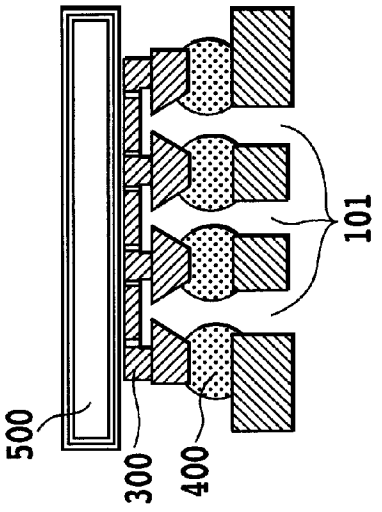


FIG. 3C

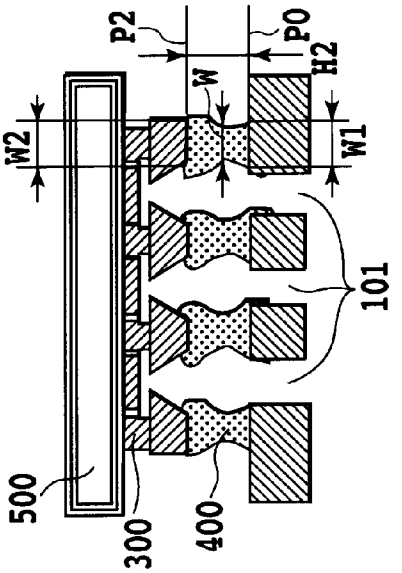


FIG. 3D

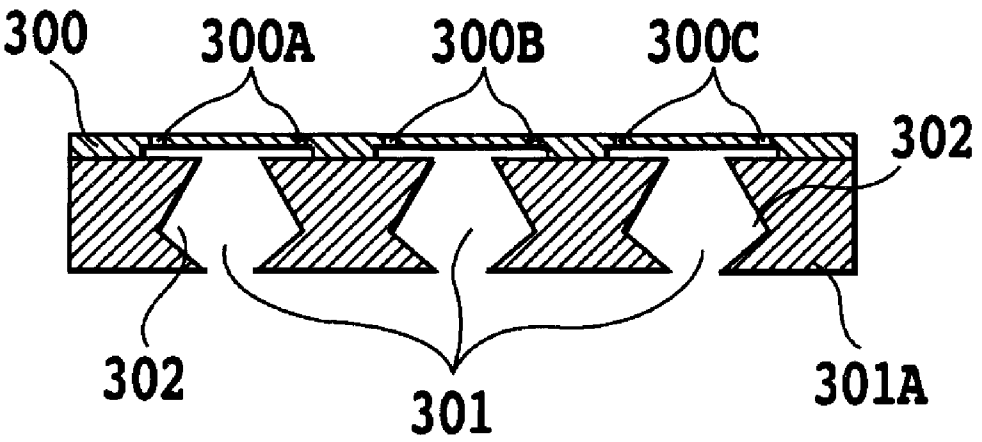


FIG.4

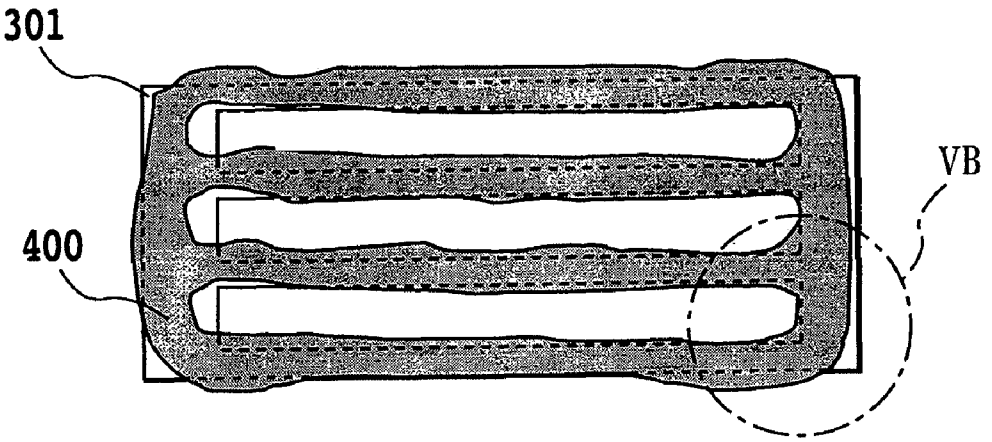


FIG.5A

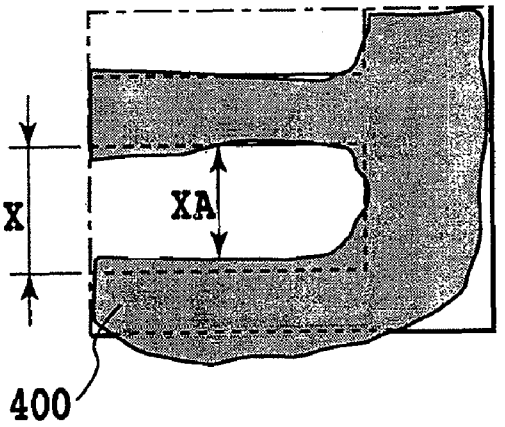


FIG.5B

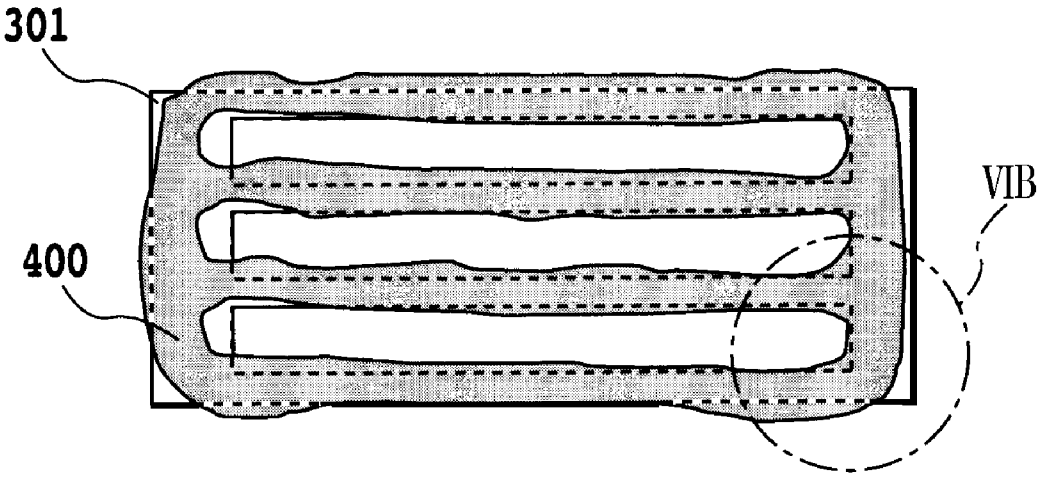


FIG.6A

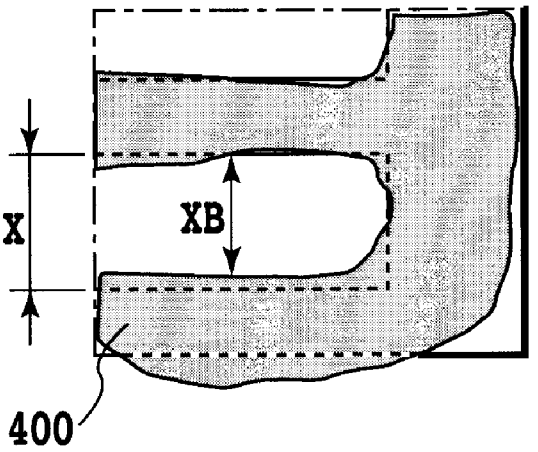


FIG.6B

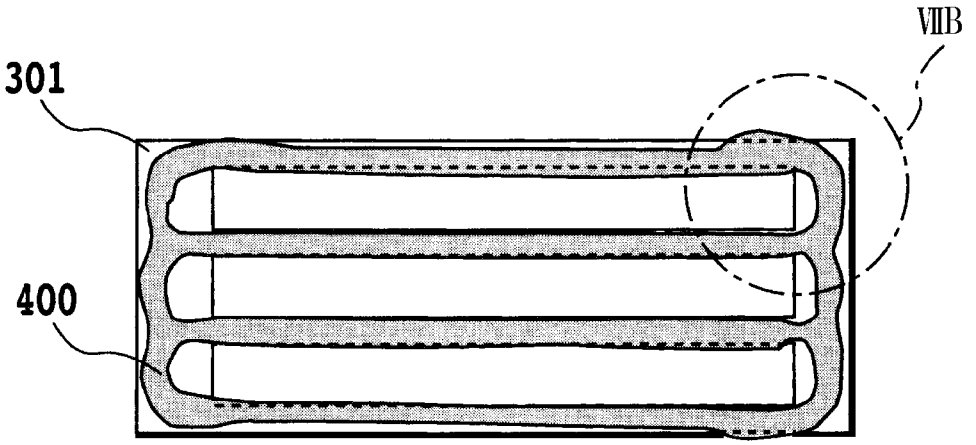


FIG.7A

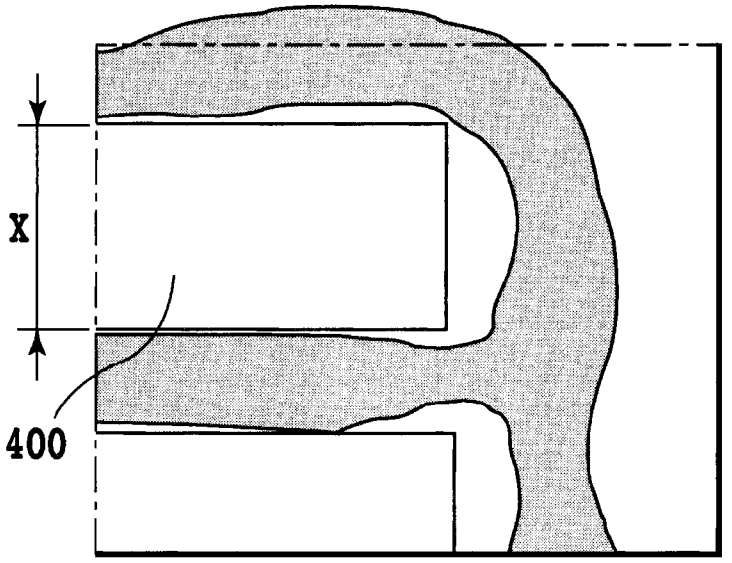


FIG.7B

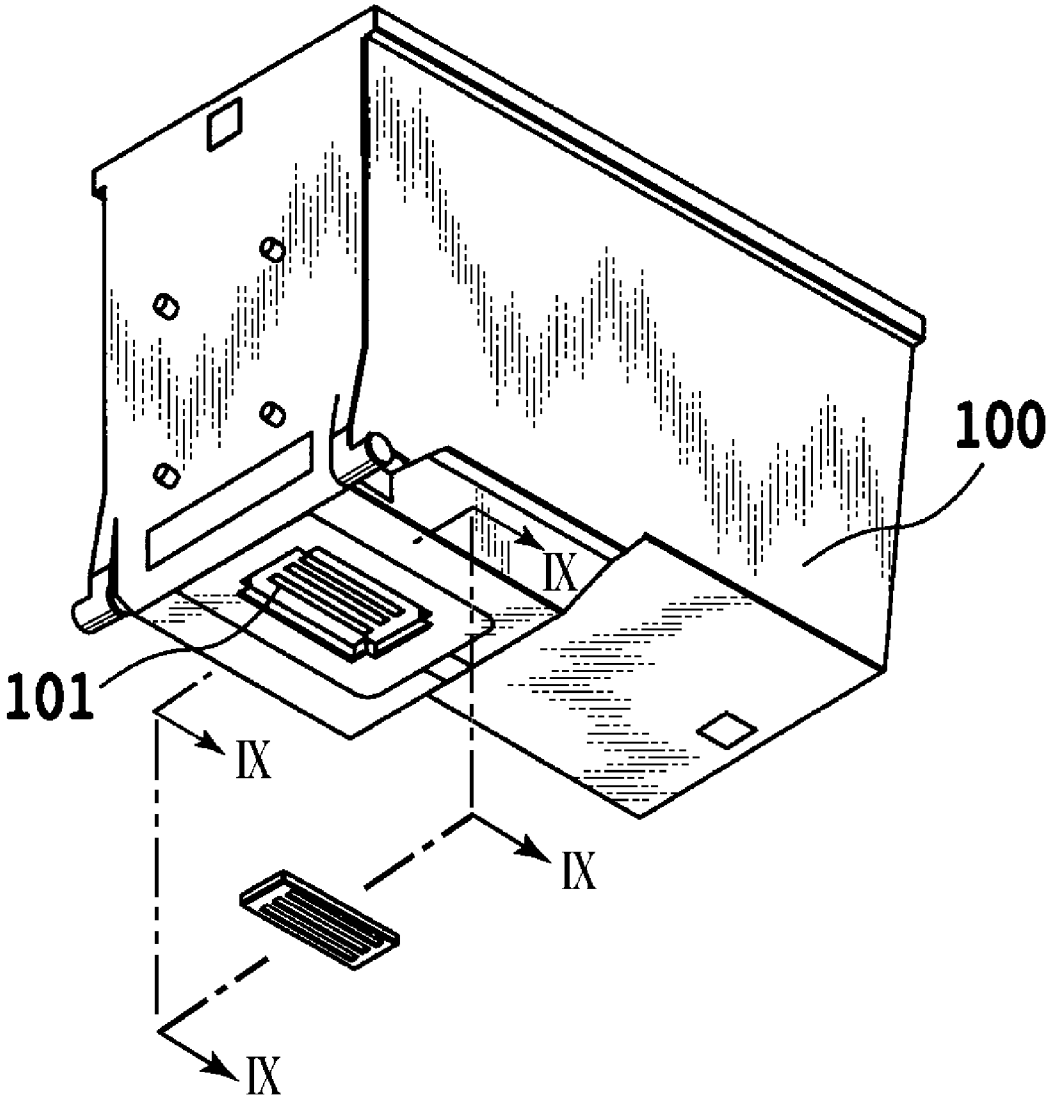


FIG.8

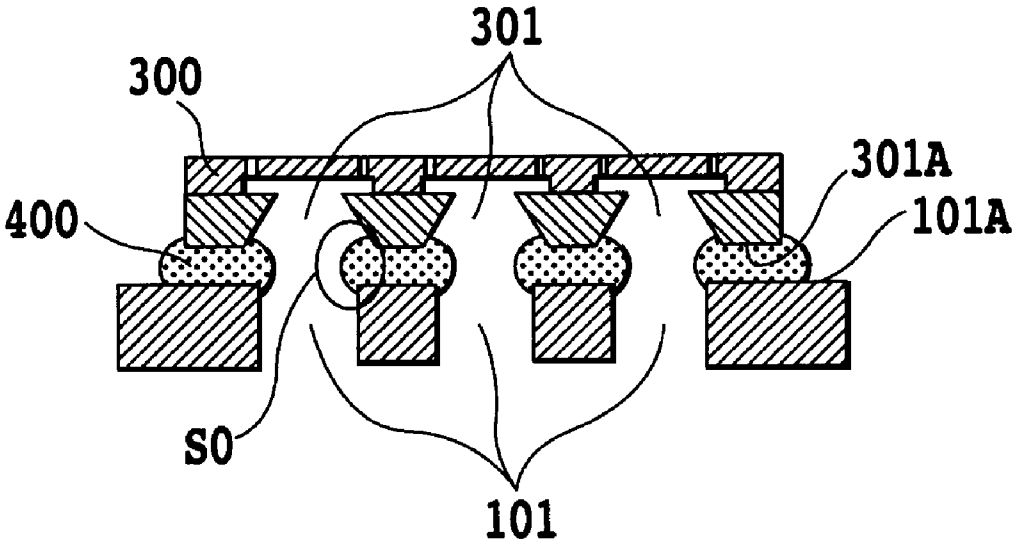


FIG.9

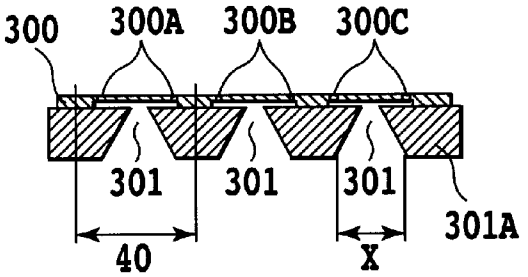


FIG.10A

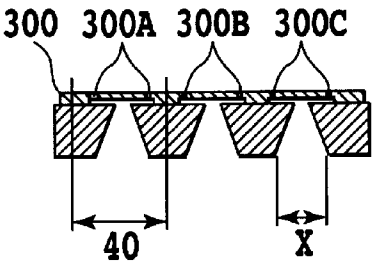


FIG.10B

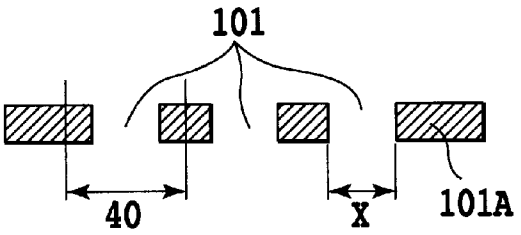


FIG.10C

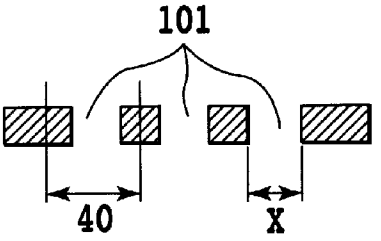


FIG.10D

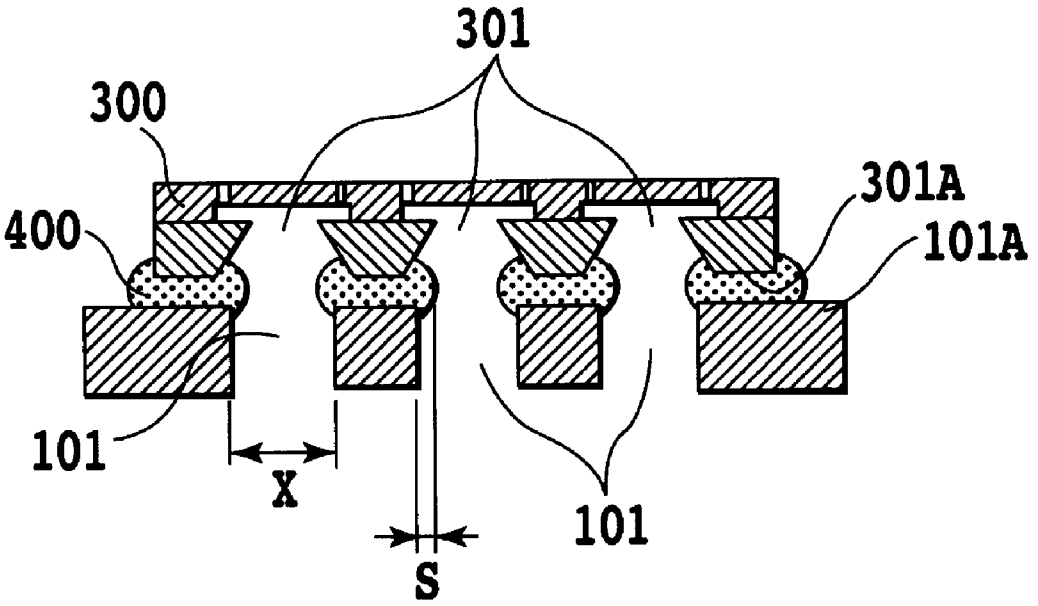


FIG.11A

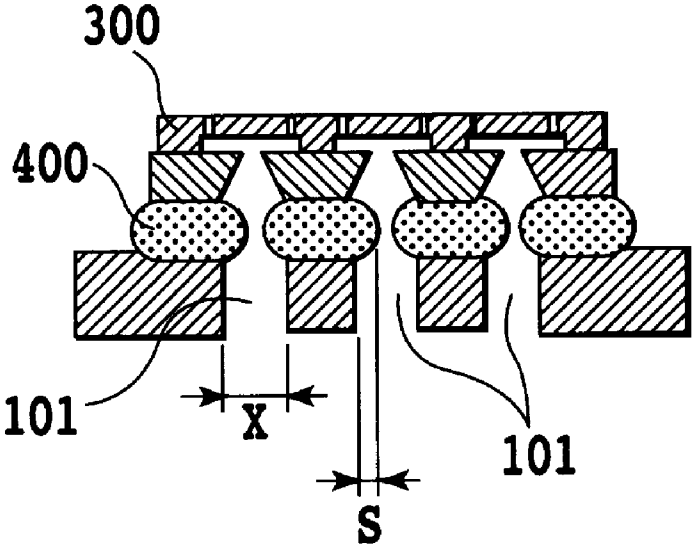


FIG.11B

INK JET PRINT HEAD MANUFACTURING METHOD AND INK JET PRINT HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of manufacturing an ink jet print head in which an ink ejecting print element and a support member capable of supplying ink to the print element are bonded together with adhesive. The invention also relates to such an ink jet print head.

2. Description of the Related Art

An example of currently available ink jet print head has a construction as shown in FIG. **8**, in which a support member **100** and a chip-like print element substrate **300** are bonded together with an adhesive **400** (see FIG. **9**). The print element substrate **300** is bonded to areas surrounding ink supply ports **101** in the support member **100**. The print element substrate **300** has a plurality of ejection openings formed therein to eject ink supplied from the ink supply ports **101** of the support member **100**. The print element substrate **300** also has an electrothermal conversion element (heater) or a piezoelectric element to create an ink ejection energy.

As shown in FIG. **9**, the adhesive **400** applied to the areas surrounding the ink supply ports **101** of the support member **100** is pressed by, and spreads over the back of, the print element substrate **300** as the print element substrate **300** is bonded to the support member **100**. FIG. **9** is an enlarged cross section of FIG. **8**, showing a bonded portion between the print element substrate **300** and the areas surrounding the ink supply ports **101** of the support member **100**. FIG. **9** corresponds to a cross section of the print element substrate **300** taken along the line IX-IX of FIG. **8** and a cross section of the areas surrounding the ink supply ports **101** taken along the line IX-IX of FIG. **8**. Designated **101**A is a surface of the support member **100** in which the ink supply ports **101** are formed. Denoted **301** is a surface of the print element substrate **300** in which ink introducing ports **301** are formed. S**0** indicates a squeezed-out portion of the adhesive **400**.

When the amount of the squeezed-out portion S**0** of the adhesive **400** becomes large, a possibility increases that communication portions between the ink supply ports **101** and the ink introducing ports **301** may be narrowed. The communication portions, when narrowed, may cause quality degradation of printed images due to possible ink ejection failures, leading to a deteriorated yield of print head production. It is therefore necessary to control the amount of squeezed-out portion of the adhesive **400**.

As a method for controlling the amount of squeezed-out portion of the adhesive **400**, Japanese Patent Laid-Open Nos. 2001-162802 and 2001-47620 proposed a method of absorbing an excess amount of the adhesive **400** into a groove formed in a bonding surface.

To reduce the manufacturing cost of the ink jet print head, there is a growing need in recent years to make the print element substrate **300**, the most expensive component in the print head, as small as possible.

FIG. **10**A is a cross section of the existing print element substrate **300** of a relatively large size, taken along the line IX-IX of FIG. **8**. FIG. **10**B is a cross section of the print element substrate **300** of a smaller size, taken along the line IX-IX of FIG. **8**. FIG. **10**C is a cross section, taken along the line IX-IX of FIG. **8**, of those areas of the support member **100** which surround the ink supply ports **101**, the support member **100** corresponding to the large size print element substrate **300** of FIG. **10**A, FIG. **10**D is a cross section, taken along the line IX-IX of FIG. **8**, of those areas of the support member **100** which surround the ink supply ports **101**, the support member **100** corresponding to the small size print element substrate **300** of FIG. **10**B. The print element substrate **300** of this example has three ink introducing ports **301** formed therein, to which three different kinds of inks having different colors or the like can be supplied from the three ink supply ports **101** of the support member **100**. The print element substrate **300** is formed with three sets of ejection opening arrays (**300**A, **300**B, and **300**C), one for each of the three different inks. The pitch **40** between the three ink introducing ports **301** of the print element substrate **300** matches the pitch between the three ink supply ports **101** of the support member **100**. The pitch **400** is hereinafter referred to also as an "inter-color pitch". The width X of the ink introducing ports **301** matches the width of the ink supply ports **101**.

As the print element substrate **300** is reduced in size, the inter-color pitch **40** of the print element substrate **300** also decreases as shown in FIG. **10**B. At the same time, the inter-color pitch **40** of the support member **100** also decreases as shown in FIG. **10**D. The reduction in the inter-color pitch **40** causes the widths X of the ink supply ports **101** and the ink introducing ports **301** to shrink. Since these widths X are required to smoothly supply ink to the print element substrate **300**, it is necessary to secure an appropriate size for the width X to ensure precise ink ejections and thereby maintain a high print quality.

In the existing print element substrate **300**, a sufficient width X can be secured even if the adhesive **400** is squeezed out into the inside of the ink supply ports **101** and the ink introducing ports **301** by an amount S, as shown in FIG. **11**A. So, if the adhesive **400** is squeezed out to some extent, there is little possibility of the communication portions between the ink supply ports **101** and the ink introducing ports **301** being narrowed to such a degree as will degrade the print quality.

However, in the case of the small size print element substrate **300**, since the width is narrow, a sufficient width X is difficult to secure when the adhesive **400** is squeezed out by an amount S, as shown in FIG. **11**B. So, even if the squeeze-out amount of the adhesive **400** is relatively small, the ink paths between the ink supply ports **101** and the ink introducing ports **301** are likely to be narrowed to a degree that could affect the print quality.

As a measure to solve this problem, a conceivable method may be to have an excess amount of the adhesive **400** absorbed into a groove, as proposed in Japanese Patent Laid-Open Nos. 2001-162802 and 2001-47620. However, when the print element substrate **300** is smaller as in the case of FIG. **11**B, it is difficult to secure enough space to form the groove in order to prevent the adhesive **400** from being squeezed out into the ink path.

Another possible method may involve reducing the amount of adhesive **400** applied to the areas surrounding the ink supply ports **101** so as to reduce the squeezed-out volume of the adhesive **400**. However, the amount of adhesive **400** to be applied needs to be determined by considering the surface precision of an ink supply port forming surface **101**A and an ink introducing port forming surface **301**A, the height of the adhesive **400** applied, and precision variations of a print head assembly machine. Therefore, to reduce the amount of adhesive **400** requires increasing the surface precision of the ink supply port forming surface **101**A and the ink introducing port forming surface **301**A, reducing the height of the adhesive **400** applied, and increasing the precision of the assembly machine, which in turn results in an increase in cost.

SUMMARY OF THE INVENTION

The present invention provides an ink jet print head manufacturing method and an ink jet print head in which the shape

of an adhesive to bond a support member and the print element substrate is controlled so that even if the print element substrate is reduced in size, a high ink ejection performance can be maintained.

In the first aspect of the present invention, there is provided a method of manufacturing an ink jet print head, wherein the print head has a print element substrate and a support member bonded together with an adhesive, the print element being capable of ejecting ink introduced from an ink introducing port, the support member having an ink supply port formed therein to supply ink to the ink introducing port, the manufacturing method comprising: a first step of applying the adhesive to at least one of an ink introducing port forming surface of the print element formed with the ink introducing port and an ink supply port forming surface of the support member formed with the ink supply port; a second step of, after the first step, bringing the ink introducing port forming surface and the ink supply port forming surface close together until they come into contact with each other through the adhesive; a third step of, after the second step, increasing a gap between the ink introducing port forming surface and the ink supply port forming surface to elongate the adhesive between the ink introducing port forming surface and the ink supply port forming surface; and a fourth step of, after the third step, hardening the adhesive elongated between the ink introducing port forming surface and the ink supply port forming surface.

In the second aspect of the present invention, there is an ink jet print head, which has a print element and a support member bonded together with an adhesive, the print element being capable of ejecting ink introduced from an ink introducing port, the support member having an ink supply port formed therein to supply ink to the ink introducing port, wherein an ink introducing port forming surface of the print element formed with the ink introducing port and an ink supply port forming surface of the support member formed with the ink supply port are bonded together with the adhesive; wherein a width of an intermediate portion of the adhesive disposed between the ink introducing port forming surface and the ink supply port forming surface is smaller than a width of a bonding surface of the adhesive with at least the ink introducing port forming surface or the ink supply port forming surface.

In the third aspect of the present invention, there is an ink jet print head, which has a print element and a support member bonded together with an adhesive, the print element being capable of ejecting ink introduced from an ink introducing port, the support member having an ink supply port formed therein to supply ink to the ink introducing port, wherein an ink introducing port forming surface of the print element formed with the ink introducing port and an ink supply port forming surface of the support member formed with the ink supply port are bonded together with the adhesive; wherein an intermediate portion of the adhesive disposed between the ink introducing port forming surface and the ink supply port forming surface is situated outside at least one of the ink introducing port and the ink supply port.

With this invention, the shape of the adhesive is controlled by spreading the adhesive disposed between the support member and the print element substrate and hardening it, to enable a large enough ink path to be formed between the ink supply port of the support member and the ink introducing port of the print element substrate. This allows the print element substrate, even if reduced in size, to smoothly supply ink, maintaining a high ink ejection performance and printing high-quality images. The invention also improves yields of print head manufacturing and thereby provides the high quality print head at lower cost.

Further features of the present invention will become apparent from the following description of exemplary embodiments (with reference to the attached drawings).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view showing an example construction of an ink jet print head of this invention;

FIG. **2** is a flow chart showing a process of manufacturing the ink jet print head of this invention;

FIGS. **3**A, **3**B, **3**C and **3**D are enlarged cross sectional views of bonded portions between a print element substrate and a support member in the manufacturing process of FIG. **2**;

FIG. **4** is a cross-sectional view of the print element substrate having rectangular portions;

FIG. **5**A is a back view of a major part of the print element substrate, showing a comparative example of squeezed-out portions of an adhesive, and FIG. **5**B is an enlarged view of part VB in FIG. **5**A;

FIG. **6**A is a back view of a major part of the print element substrate, showing an another comparative example of squeezed-out portions of an adhesive, and FIG. **6**B is an enlarged view of part VIB in FIG. **6**A;

FIG. **7**A is a back view of a major part of the print element substrate, showing a further comparative example of squeezed-out portions of an adhesive, and FIG. **7**B is an enlarged view of part VIIB in FIG. **7**A;

FIG. **8** is an exploded perspective view of the ink jet print head;

FIG. **9** is an enlarged cross-sectional view of essential portions of a conventional ink jet print head, showing squeezed-out portions of an adhesive;

FIG. **10**A is a cross-sectional view of an existing print element substrate, FIG. **10**B is a cross-sectional view of a small-size print element substrate, FIG. **10**C is a cross-sectional view of ink supply ports corresponding to the print element substrate of FIG. **10**A, and FIG. **10**D is a cross-sectional view of ink supply ports corresponding to the print element substrate of FIG. **10**B; and

FIG. **11**A is a cross-sectional view of a conventional print head with a print element substrate of the existing size, and FIG. **11**B is a cross-sectional view of a conventional print head with a print element substrate of a smaller size.

DESCRIPTION OF THE EMBODIMENTS

Now, embodiments of this invention will be described by referring to the accompanying drawings.

FIG. **1** is a perspective view showing an example of an overall construction of an ink jet print head according to this invention. Portions similar to those of the conventional print head are assigned like reference numerals and their explanations are omitted here.

In the print head of this example, a lead portion of an electric wiring tape **200** is electrically connected to electrode terminals of a chip-like print element substrate **300**. The print element substrate **300** is bonded with an adhesive **400** to a surface of a support member **100** at areas surrounding ink supply ports **101**. The electrode terminals of the print element substrate **300** and exposed parts of the lead portion of the electric wiring tape **200** are sealed with a sealing agent.

In a step of bonding an ink introducing port forming surface **301**A of the print element substrate **300** to areas surrounding the ink supply ports **101** of the support member **100**

(ink supply port forming surface **101**A), the adhesive **400** is applied by dispensing or transfer printing or the like. In the case of dispensing, a work (support member **100** or print element substrate **300**) and a syringe with a needle (filled with the adhesive **400**) are set in a 3-axis application device. Then, the adhesive **400** is applied to predetermined points arranged in line or in scattered dots on the work. In the case of transfer printing, the adhesive **400** is spread to a uniform height on a disk that is rotating at a constant speed. Then, transfer pins arranged in a pattern that matches an adhesive application area (ink supply port forming surface **101**A or ink introducing port forming surface **301**A) are moved up and down to transfer the adhesive **400**. The adhesive **400** may generally be of ultraviolet cure type that hardens upon being radiated with ultraviolet light, or thermosetting type that hardens when heated, or a combination of these.

FIG. **2** is a flow chart showing a sequence of steps for bonding the print element substrate **300** to the surface of the support member **100** at the areas surrounding the ink supply ports **101**. FIGS. **3**A to **3**D are enlarged cross-sectional, views of bonding parts during the process of FIG. **2**.

First, the support member **100** is fixed at a predetermined position using a dedicated fixing jig (step S**1**). The method for positioning and fixing the support member **100** may involve using a reference surface (not shown) and then positioning and fixing the support member **100** with an accuracy of ±10 μm or less.

Next, the adhesive **400** is applied or transferred to the areas of the support member **100** surrounding the ink supply ports **101** by dispensing or transfer printing (step S**2**). In this example, an ultraviolet cure adhesive with a viscosity of around 10,000 cps was used as the adhesive **400** and applied by dispensing. The height H**0** (see FIG. **3**A) of the adhesive **400** from the point P**0** on the surface of the areas surrounding the ink supply ports **101** was set to about 120 μm. The adhesive **400** may be a thermosetting type, or a combination of ultraviolet cure type and thermosetting type. The adhesive **400** needs only to be applied to at least one of the portions on the ink supply port forming surface and on the ink introducing port forming surface.

Next, the print element substrate **300**, electrically connected to the electric wiring tape **200**, is sucked and held by a handling unit **500** (see FIG. **3**A) (step S**3**). The print element substrate **300** may also be held by a mechanical clamp or a combination of the mechanical clamp and suction. Next, an image of the print element substrate handled is taken and processed to measure its position and determine a distance between the print element substrate **300** and the support member **100** (step S**4**). In the image processing, the resolution used to determine the position of the print element substrate **300** is, for example, 0.5 μm or less.

FIG. **3**A illustrates a state following the end of the image processing step (step S**4**), showing the print element substrate **300** held by the handling unit **500**. The adhesive **400** maintains its bulging shape on the surface of the areas surrounding the ink supply ports **101** by its own surface tension.

Then, in a bonding operation **1** (step S**5**), the print element substrate **300** is moved by the handling unit **500** according to the positional relation between the print element substrate **300** and the support member **100** determined at the previous image processing step (step S**4**). Then, the ink introducing port forming surface **301**A of the print element substrate **300** is located at a first position P**1**. The first position P**1** is a position at which the ink introducing port forming surface **301**A is completely in contact with the adhesive **400**, as shown in FIG. **3**B. Thus, the ink supply port forming surface **101**A and the ink introducing port forming surface **301**A are indirectly in contact with each other through the adhesive **400**. In this example, a gap H**1** between the position P**0** of the ink supply port forming surface **101**A of the support member **100** and the first position P**1** was set at about 70 μm. As the ink introducing port forming surface **301**A moves to the first position P**1**, the adhesive **400** gets depressed to a predetermined degree between the print element substrate **300** and the support member **100**, and bulges out to the sides as shown in FIG. **3**B. The first position P**1** varies depending on the height H**0** of the applied adhesive **400** in the application step (step **32**). The resolution with which to control the movement of the print element substrate **300** by the handling unit **500** may, for example, be 1 μm or less.

FIG. **4** is a cross-sectional view of the print element substrate **300** having rectangular recessed portions **302** formed inside the ink introducing ports **301**. The recessed portions **302** may accommodate excess volumes of adhesive **400**.

After this, in a bonding operation **2** (step S**6**), the print element substrate **300** is moved in a direction that increases the gap between the print element substrate **300** and the support member **100** from the first gap H**1**, as shown in FIG. **3**C and FIG. **3**D. FIG. **3**C shows the gap H**1** being increased as the print element substrate **300** is moved by the handling unit **500**, until it reaches a second gap H**2** as shown in FIG. **3**D. As a result of the movement of the print element substrate **300**, the adhesive **400**, that was depressed and bulging toward the sides in the bonding operation **1** (step S**5**), is pulled, reducing the bulging amount of the squeezed-out portion, as shown in FIG. **3**D. In this example, the final second gap H**2** was set to about 150 μm.

When the gap between the print element substrate **300** and the support member **100** is increased to the gap H**2** as shown in FIG. **3**D, the adhesive **400** that was squeezed out toward the sides is pulled and elongated and gets a recessed middle portion so as to have a shape including a constricted part. As a result, an intermediate portion of the adhesive **400** situated between the ink introducing port forming surface **301**A and the ink supply port forming surface **101**A is reduced in width W in a horizontal direction in FIG. **3**D. When W**1** and W**2** denote the widths of contact surfaces of the adhesive **400** with the ink introducing port forming surface **301**A and the ink supply port forming surface **101**A in the horizontal direction in FIG. **3**D, the width W is smaller than at least one of W**1** and W**2**. The intermediate portion of the adhesive **400** is situated outside at least the ink introducing port **301** or the ink supply port **101**. That is, the intermediate portion of the adhesive **400** lies outside a space defined by the ink introducing ports **301** being extended downward in FIG. **3**D and/or outside a space defined by the ink supply ports **101** being extended upward in FIG. **3**D.

If the width of the ink supply port **101** and the width of the ink introducing port **301** differ, the intermediate portion of the adhesive **400** needs only to be situated outside of the ink supply port **101** or the ink introducing port **301** smaller in width.

Then it is possible to secure large enough ink path between the ink supply port **101** and the ink introducing port **301**.

In this example, the print element substrate **300** was moved to widen the gap between the print element substrate **300** and the support member **100**. It is also possible to move the support member **100** or both of the print element substrate **300** and the support member **100**.

Next, in an adhesive hardening operation **1** (step S**7**), ultraviolet light is shone for about 5 seconds to preliminarily harden the adhesive **400**. This hardens the adhesive **400** to a degree that sustains the shape of the adhesive **400** and which prevents the print element substrate **300** from shifting from

the surface of the areas surrounding the ink supply ports **101** due to vibrations during its transport to the next step. Another method for provisional hardening of the adhesive **400** includes the use of hot air and halogen light from a heat source.

Next, in an adhesive hardening operation **2** (step S**8**), the adhesive **400** that was preliminarily hardened in the preceding adhesive hardening operation **1** (step S**7**) is heated in a cure furnace at around 100° C. for one hour for complete hardening. If the adhesive **400** can be hardened enough in the previous adhesive hardening operation **1** (step S**7**), the adhesive hardening operation **2** (step S**8**) is not required.

FIG. **5**A to FIG. **7**B are drawings for explaining a degree of the extension of the adhesive **400** by the bonding operation **2** (step S**6**).

FIG. **5**A and FIG. **5**B represent a case in which the gap H**1** between the print element substrate **300** and the support member **100** is maintained without being increased in the bonding operation **2** (step S**6**). FIG. **5**A shows an observation on a squeezing out state of the adhesive **400**, as seen from the ink introducing ports **301** side of the print element substrate **300**. FIG. **5**B is an enlarged view of a portion VB in FIG. **5**A. The squeezed-out portions of the adhesive **400** narrowed the width XA of the ink path between the ink supply port **101** and the ink introducing port **301**, with the result that the width XA is smaller than the width X of the ink supply port **101**.

FIG. **6**A and FIG. **6**C represent a case in which the gap H**1** between the print element substrate **300** and the support member **100** is widened from 70 μm to the gap H**2** of about 100 μm in the bonding operation **2** (step S**6**). FIG. **6**A shows an observation on a squeezing out state of the adhesive **400**, as seen from the ink introducing ports **301** side of the print element substrate **300**. FIG. **6**B is an enlarged view of a portion VIB in FIG. **6**A. These figures show that the amount of squeezed-out portion of the adhesive **400** is advantageously smaller than that of FIG. **5**A and FIG. **5**B. However, the width XB (>XA) of the ink path between the ink supply port **101** and the ink introducing port **301** is somewhat narrower than the width X of the ink supply port **101**.

FIG. **7**A and FIG. **7**B represent a case in which the gap H**1** between the print element substrate **300** and the support member **100** is widened from 70 μm to the gap H**2** of about 200 μm in the bonding operation **2** (step S**6**). FIG. **7**A shows an observation on a squeezing out state of the adhesive **400**, as seen from the ink introducing port forming surface **301**A side of the print element substrate **300**. FIG. **7**B is an enlarged view of a portion VIIB in FIG. **7**A. These figures show that the squeezed-out portion of the adhesive **400** no longer exists and that the width of the ink path between the ink supply port **101** and the ink introducing port **301** is not smaller than the width X of the ink supply port **101**. It is, however, noted that the adhesive **400** is stretched excessively.

In this example, therefore, the adhesive **400** with a viscosity of around 10,000 cps was used and, during the bonding operation **2** (step S**6**), the gap H**2** between the support member **100** and the print element substrate **300** was set to about 150 μm. It was found that the adhesive **400** was not extended excessively and that the amount of squeezed-out portion was able to be controlled.

In the bonding operation **2** (step S**6**), by how much the gap between the support member **100** and the print element substrate **300** should be increased may be determined optimally according to the amount of adhesive **400** to be applied, its characteristics (viscosity) and the surface conditions of the bonding surfaces (ink supply port forming surface and ink introducing port forming surface). This allows the amount of squeezed-out portion of the adhesive **400** to be minimized effectively.

As described above, by elongating the adhesive **400** in the bonding operation **2** (step S**6**) followed by its hardening, the squeezed-out portion size of the adhesive **400** can be minimized to secure a sufficient width of the ink supply ports **101**. It is therefore possible to secure sufficient ink paths even if a small-size print element substrate **300**, such as shown in FIG. **10**B, is bonded, thus eliminating problems of insufficient ink supply and ink ejection failures caused by narrowed ink path and therefore a problem of degradation of print quality. This in turn improves a production yield of the print head, lowering its cost.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2008-157899, filed Jun. 17, 2008, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A method of manufacturing an ink jet print head comprising:

a first step of preparing a print element substrate, a support member for supporting the print element substrate, and an adhesive, the print element substrate having an ink ejection opening for ejecting ink and an ink introducing port forming surface formed with an ink introducing port for introducing ink to the ink ejection opening, the support member having an ink supply port forming surface formed with an ink supply port for supplying ink to the ink introducing port, the adhesive being applied to at least one of the ink introducing port forming surface and the ink supply port forming surface;

a second step of sandwiching the adhesive between the ink introducing port forming surface and the ink supply port forming surface;

a third step of increasing a gap between the ink introducing port forming surface and the ink supply port forming surface, with the adhesive sandwiched between the ink introducing port forming surface and the ink supply port forming surface, to elongate the adhesive between the ink introducing port forming surface and the ink supply port forming surface; and

a fourth step of hardening the adhesive elongated between the ink introducing port forming surface and the ink supply port forming surface.

2. The ink jet print head manufacturing method according to claim **1**, wherein the second step depresses the adhesive between the ink introducing port forming surface and the ink supply port forming surface to a predetermined degree.

3. The ink jet print head manufacturing method according to claim **1**, wherein the third step elongates the adhesive until a small width portion of the adhesive is formed, the small width portion being positioned at a portion other than a contact surface of the adhesive contacting at least one of the ink introducing port forming surface and the ink supply port forming surface, a width of the small width portion in a cross-section perpendicular to the contact surface being smaller than that of the contact surface in the cross-section.

4. The ink jet print head manufacturing method according to claim **3**, wherein the third step elongates the adhesive until the small width portion is situated outside at least one of the ink introducing port and the ink supply port.

5. The ink jet print head manufacturing method according to claim 3, wherein the third step elongates the adhesive until the small width portion is formed at an intermediate portion of the adhesive disposed between the ink introducing port forming surface and the ink supply port forming surface.

6. The ink jet print head manufacturing method according to claim 1,

wherein a plurality of ink introducing ports and ink supply ports are provided and the adhesive is applied to at least those areas on the ink introducing port forming surface which surround the plurality of the ink introducing ports or those areas on the ink supply port forming surface which surround the plurality of the ink supply ports.

7. The ink jet print head manufacturing method according to claim 1, wherein the fourth step includes a step of preliminarily hardening the adhesive.

8. An ink jet print head comprising:

a print element substrate having an ink ejection opening for ejecting ink and an ink introducing port forming surface formed with an ink introducing port for introducing ink to the ink ejection opening; and

a support member having an ink supply port forming surface formed with an ink supply port for supplying ink to the ink introducing port, the ink supply port forming surface being bonded with the ink introducing port forming surface to support the print element substrate by an adhesive,

wherein the adhesive has a small width portion, the small width portion being positioned at a portion other than a contact surface of the adhesive contacting at least one of the ink introducing port forming surface and the ink supply port forming surface, a width of the small width portion in a cross-section perpendicular to the contact surface being smaller than that of the contact surface in the cross-section.

9. The ink jet print head according to claim 8,

wherein the small width portion is situated outside at least one of the ink introducing port and the ink supply port.

10. The ink jet print head according to claim 8, wherein the small width portion is an intermediate portion of the adhesive disposed between the ink introducing port forming surface and the ink supply port forming surface.

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